

WHAT IS CLAIMED

1. A method of generating an image of a terrestrial region upon which electromagnetic energy from an electromagnetic energy source is incident comprising the steps of:

5 (a) passively collecting electromagnetic energy emitted by said electromagnetic energy source by way of at least one first energy collector;

(b) passively collecting, by at least one second energy collector moving among a plurality of distributed  
10 energy collection locations, electromagnetic energy emitted by said electromagnetic energy source and scattered by features of said terrestrial region of interest;

(c) processing a reference signal representative of  
15 electromagnetic energy collected in step (a), in accordance with information representative of the collection geometry of said at least one first energy collector and the geolocation of said electromagnetic energy source, so as to derive a time- and location-  
20 corrected reference signal;

(d) correlating the time- and location-corrected reference signal derived in step (c) with an image signal representative of electromagnetic energy collected by said at least one moving second energy collector in step  
25 (b), so as to derive composite amplitude and phase values

of scattering components for plural locations of said terrestrial region as received by said at least one moving second energy collector as a function of spatial position; and

- 30       (e) processing said composite scattering components derived in step (d) to produce said multidimensional image of said terrestrial region of interest.

2. A method according to claim 1, wherein said electromagnetic energy source comprises a television signal transmitter, and step (b) comprises passively collecting electromagnetic energy emitted by said  
5 television signal transmitter, and scattered by features of said terrestrial region of interest, by means of an airborne or spaceborne electromagnetic energy collection platform moving among said plurality of distributed energy collection locations.

3. A system for deriving image information representative of cultural features of a terrestrial region illuminated by an RF transmitter comprising:

a reference signal collection subsystem which is  
5 operative to collect non-scattered RF energy emitted by said RF transmitter illuminating said terrestrial region;

a dynamic scattered image energy subsystem which is operative to travel past said terrestrial region, and

collect from plural non-coincident viewing paths of said  
10 terrestrial region, RF energy scattered from points of  
cultural features within a three-dimensional volume of  
space containing said terrestrial region; and

a collected signal processing subsystem, which is  
operative to process information representative of said  
15 non-scattered RF energy as collected by said reference  
signal collection subsystem, to derive a coherent  
reference signal corresponding to that transmitted by  
said RF transmitter illuminating said terrestrial region,  
time- and location-corrected as necessary to points  
20 within said three-dimensional volume of space, and to  
correlate said coherent reference signal with a scattered  
RF energy signal representative of electromagnetic energy  
collected by said dynamic scattered image energy  
subsystem, time- and location-corrected as necessary to  
25 said points within said three-dimensional volume of  
space, so as to derive composite amplitude and phase  
values of scattering components for said points of said  
three-dimensional space.

4. A system according to claim 3, further  
including an image generator subsystem, which is  
operative to process said composite amplitude and phase  
values of scattering components for said points of said  
5 three-dimensional space to produce a multidimensional

image of cultural features of said terrestrial region.

5. A system according to claim 3, wherein said reference signal collection subsystem and said dynamic scattered image energy subsystem are configured to employ a common RF energy collector that simultaneously collects  
5 said non-scattered RF energy emitted by said RF transmitter illuminating said terrestrial region, and RF energy scattered from points of cultural features within said three-dimensional volume of space containing said terrestrial region.

6. A system according to claim 3, wherein said reference signal collection subsystem and said dynamic scattered image energy subsystem employ respectively separate RF energy collectors that simultaneously collect  
5 said non-scattered RF energy emitted by said RF transmitter illuminating said terrestrial region, and RF energy scattered from points of cultural features within said three-dimensional volume of space containing said terrestrial region.

7. A system according to claim 5, wherein said collected signal processing subsystem includes:

a coherent reference signal processing section having a first Lorentz transform operator that accounts

5 for signal propagation delay from said transmitter to  
said reference signal collection subsystem, and performs  
a Lorentz transform of an RF energy signal received  
thereby to a static frame of reference of a respective  
point in said three-dimensional space, and a delay  
10 associated with said reference signal's propagation time  
from said transmitter to said respective point, so as to  
effectively transform a reference signal component of RF  
energy received at the collection aperture of said  
reference signal collection subsystem to said respective  
15 point, and

a dynamic scattered signal processing section having  
a second Lorentz transform operator which accounts for  
signal propagation delay and performs a second Lorentz  
transform of RF energy received by said dynamic scattered  
20 image energy subsystem from its moving frame of reference  
to the static frame of reference of said respective point  
in said three-dimensional space.

8. A system according to claim 7, wherein said  
dynamic scattered signal processing section includes a  
reference signal suppression operator coupled to remove  
a reference signal component from the scattered image  
5 component of RF energy received by said dynamic scattered  
image energy subsystem.

9. A system according to claim 8, wherein said collected signal processing subsystem includes a correlator, which is operative to correlate the output of said dynamic scattered signal processing section with the  
5 output of said coherent reference signal processing section, to derive composite amplitude and phase values of scattering components for said points of said three-dimensional space.

10. A system according to claim 9, further including an image generator subsystem, which is operative to process said composite amplitude and phase values of scattering components for said points of said  
5 three-dimensional space to produce a multidimensional image of cultural features of said terrestrial region.

11. A method for passively deriving image information representative of cultural features of a region illuminated by an RF transmitter comprising:

(a) providing a coherent reference signal  
5 representative of RF energy emitted by said RF transmitter illuminating said terrestrial region;

(b) collecting, from a plurality of mutually offset travel paths offset from said terrestrial region, RF energy scattered, as a result of illumination by RF  
10 energy emitted by said RF transmitter, from points that

are capable of defining cultural features within a three-dimensional volume of space containing said terrestrial region; and

(c) correlating said coherent reference signal,  
15 time- and location-corrected as necessary to said points within said three-dimensional volume of space, with a scattered RF energy signal representative of electromagnetic energy collected by said dynamic scattered image energy subsystem, time- and location-  
20 corrected as necessary to said points within said three-dimensional volume of space, so as to derive composite amplitude and phase values of scattering components for said points of said three-dimensional space.

12. A method according to claim 11, further including the step (d) of processing said composite amplitude and phase values of scattering components for said points of said three-dimensional space to produce a  
5 multidimensional image of cultural features of said terrestrial region.

13. A method according to claim 11, wherein steps (a) and (b) include employing a common RF energy collector to simultaneously collect non-scattered RF energy emitted by said RF transmitter illuminating said  
5 terrestrial region, and RF energy scattered from said

points of cultural features within said three-dimensional volume of space containing said terrestrial region.

14. A method according to claim 11, wherein steps (a) and (b) include employing respectively separate RF energy collectors to collect RF energy emitted by said RF transmitter illuminating said terrestrial region, and RF  
5 energy scattered from said points of cultural features within said three-dimensional volume of space containing said terrestrial region.

15. A method according to claim 13, wherein step (c) comprises:

(c1) processing said coherent reference signal in accordance with a first Lorentz transform that accounts  
5 for signal propagation delay from said transmitter to a collector for said reference signal and performs a Lorentz transform of an RF energy signal received thereby to a static frame of reference of a respective point in said three-dimensional space, and providing a delay  
10 associated with said reference signal's propagation time from said transmitter to said respective point, so as to effectively transform a reference signal component of RF energy received by said collector to said respective point, and

15           (c2) processing said scattered RF energy signal in  
accordance with a second Lorentz transform operator which  
accounts for signal propagation delay and performs a  
second Lorentz transform of RF energy received by a  
collector for said scattered RF energy signal from its  
20 moving frame of reference to the static frame of  
reference of said respective point in said three-  
dimensional space.

16. A method according to claim 15, wherein step  
(c2) includes processing said scattered RF energy signal  
in accordance with a reference signal suppression  
operator that is operative to remove a reference signal  
5 component from said scattered RF energy signal.